ORIGINAL ARTICLE

Improving Treatment Adherence in Heart Failure

A Systematic Review and Meta-analysis of Pharmacological and Lifestyle Interventions

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SUMMARY

Background: Despite improved treatment options, heart failure remains the third most common cause of death in Germany and the most common reason for hospitalization. The treatment recommendations contained in the relevant guidelines have been incompletely applied in practice. The goal of this systematic review is to study the efficacy of adherence-promoting interventions for patients with heart failure with respect to the taking of medications, the implementation of recommended lifestyle changes, and the improvement in clinical endpoints.

Methods: We performed a meta-analysis of pertinent publications retrieved by a systematic literature search.

Results: 55 randomized controlled trials were identified, in which a wide variety of interventions were carried out on heterogeneous patient groups with varying definitions of adherence. These trials included a total of 15 016 patients with heart failure who were cared for as either inpatients or outpatients. The efficacy of interventions to promote adherence to drug treatment was studied in 24 trials; these trials documented improved adherence in 10% of the patients overall (95% confidence interval [CI]: [5; 15]). The efficacy of interventions to promote adherence to lifestyle recommendations was studied in 42 trials; improved adherence was found in 31 trials. Improved adherence to at least one recommendation yielded a long-term absolute reduction in mortality of 2% (95% CI: [0; 4]) and a 10% reduction in the likelihood of hospitalization within 12 months of the start of the intervention (95% CI: [3; 17]).

Conclusion: Many effective interventions are available that can lead to sustained improvement in patient adherence and in clinical endpoints. Long-term success depends on patients' assuming responsibility for their own health and can be achieved with the aid of coordinated measures such as patient education and regular follow-up contacts.

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In spite of improved treatment options, heart failure is the third most common cause of death in Germany and constitutes the most common cause for inpatient admission to hospital (1). This disease burden has remained unchanged at this high level for patients and the healthcare system in spite of falling cardiovascular death rates (2–5) and the successful development of medication treatments. The efficacy of these therapies has been shown in large multicenter studies across all stages and grades of severity of the disorder. This holds true for the introduction of angiotensin converting enzyme (ACE) inhibitors, beta receptor blockers, antiotensin-1 antagonists, and aldosterone antagonists (6–10).

The prognosis for patients can additionally be improved effectively by disorder-specific lifestyle modifications and optimized self-care. These measures include, among others:

- Monitoring for fluid retention by means of regular control of body weight and checking for leg edema (11, 12)
- Independent adjustment of the medication according to agreed schemes
- Putting dietary recommendations into practice (13).

These therapeutic recommendations have found their way into the current guidelines regarding healthcare provision for patients with heart failure (14–16), but they are realized in patients' everyday lives to an unsatisfactory degree. In this setting, the term adherence describes the extent to which a patient's behavior with regard to medication intake or lifestyle changes is consistent with therapeutic recommendations (17). In contrast to the term compliance, which was used in the past, adherence implies a therapeutic alliance between doctor and patient, with joint decision making and support for self-care.

In recent years it has been shown repeatedly that in evidence-based and prognosis-relevant treatment measures, a clear interaction exists between adherence and the subsequent prognosis. In a recent cohort study, non-adherent patients accounted for 22.1% of all hospital admissions for clinically manifest heart failure, and they had a markedly shorter time interval until

Inclusion criteria

● Population
Patients with heart failure

● Intervention
Strategies to improve patients' adherence to
taking their medication and self care
– Training/education for patients
– Reminder systems for patients
– Measures to improve self care
– Doctor oriented strategies
– Organizational changes
– Technical solutions

● Control group
Standard care or other (less intensive) implementation
strategy

● Endpoint
Patients' adherence after a minimum of 3 months' follow-
up to
– Regular medication intake (for example, of ACE
  inhibitors or AT_1 antagonists, beta-blockers, diuretics)
– Symptom and weight control to detect fluid retention
  early
– Low-salt diet
– Restricted fluid intake
– Support for/promotion of moderate physical activity
– Avoidance of risk factors (for example, smoking)

ACE, angiotensin converting enzyme; AT, angiotensin

readmission to hospital (hazard ratio [HR] 0.45; 95%
confidence interval [CI]: [0.25; 0.52]) (18). It is well
known that low adherence to antihypertensive treat-
ment notably increases the risk for clinically manifest
heart failure (19).

On the background of the great prognostic impor-
tance of limited adherence in chronic heart failure, this
systematic review aims to answer the following ques-
tions:
● Is it possible to support patients with heart failure
  and to improve their adherence to medication
  therapy and lifestyle modifications in a sustained
  fashion?
● Is improved adherence on the patients' part
  associated with improved clinical outcomes, such
  as lower mortality, fewer inpatient stays in hospi-
  tal, and improved quality of life?

Methods

This systematic review aims to summarize all rand-
omized intervention studies of the improvement of ad-
herence in patients with heart failure. The *Box* shows
the inclusion criteria.

Literature search

The study was conducted on the basis of the registered
(reg No CRD42014009477) and published study proto-
col (20). The results were reported in accordance with
the PRISMA guidelines (21). We searched the data-
bases Medline (Ovid), EMBASE, CENTRAL, Psyc-
Info, and CINAHL in July 2014 for all suitable studies
that had been published since 2000 in English or Ger-
man. In addition, we manually searched the reference
lists of the included studies and systematic reviews.

Study selection and data extraction

The authors SU, FS, or SM checked—independently
from one another—titles, summaries/abstracts, and
potentially relevant full-text versions on the basis of the
inclusion criteria. Information on patients' adherence
was described by using frequency data or scores on
medication intake (*eTable 1*) and implementation of life-
style modifications (*eTable 2*). In order to ensure that pa-
tients stuck to the interventions, a follow-up period of at
least 3 months was a prerequisite for inclusion. Dis-
agreements on the inclusion of studies were discussed
with RP. Subsequently, the information set out in the
study protocol was extracted by FS and SM and checked
by MU. In addition to process parameters on adherence,
we also collected data on patient-relevant result
parameters, such as quality of life, mortality, and fre-
quency and duration of hospital inpatient stays. The
methodological quality of the studies was assessed on
the basis of the recommendations of the Cochrane
Collaboration (22).

Effect sizes

We calculated the effect size by comparing the frequen-
cies of adherent behavior in the intervention and control
groups. Furthermore, we calculated risk differences
(RD) and numbers needed to treat (NNT). For metri-
cally captured adherence we determined standardized
mean differences (SMD). Positive differences describe
improved adherence in the intervention group. The
SMD allows for comparability of adherence, which was
quantified by using several scores (23) and also shows
the extent of the standard deviations by which each
score was improved by applying the strategies. The
treatment effects in the individual studies were summar-
ized by using the random effects model, and the risk of
publication bias was investigated by using a funnel plot.

Results

The systematic search identified 5340 potentially rel-
evant articles. After checking titles and abstracts and
reading 211 full text articles, we included 55 studies in
our review. Altogether 24 studies reported on adher-
ence to medication therapy and 42 studies on lifestyle
modifications; 11 studies reported on both subjects
(*Figure 1*).

Description of included studies

The 55 studies that were included in this review had
been conducted in 17 countries on four continents and

investigated the efficacy of adherence-improving measures in a total of 15 016 patients with heart failure. All studies had used a randomized design; as a rule, randomization took place at the level of the patients and in two studies at the level of doctors' practices.

Patients

Patients were recruited after an acute event in hospital in 39 studies; in 16 studies, they were recruited in a stable condition in the outpatient setting. 62% of study participants were men; three studies included men only. The mean age ranged between 51 years and 78 years. Patients were affected by different limitations in terms of physical resilience and comorbidities such as diabetes, hypertension, fat metabolism disorders, chronic renal failure, or depression. Individual studies excluded patients with severe psychological or cognitive impairments (15 studies), and others excluded patients with renal failure (11 studies).

Interventions

In most studies, several types of intervention were combined so as to improve adherence by various means—and thus a patient's prognosis.

Training/education sessions for patients—All studies described training measures for patients on the following topics: disease course and how to deal with the disorder, necessary therapeutic steps, early detection of deteriorating symptoms, and necessary lifestyle modifications. The training sessions were provided on the basis of individual treatment plans by nursing staff or pharmacists and were complemented by lectures, discussion services, brochures, newsletters, computer programs, or other learning materials—interactive ones, in some cases.
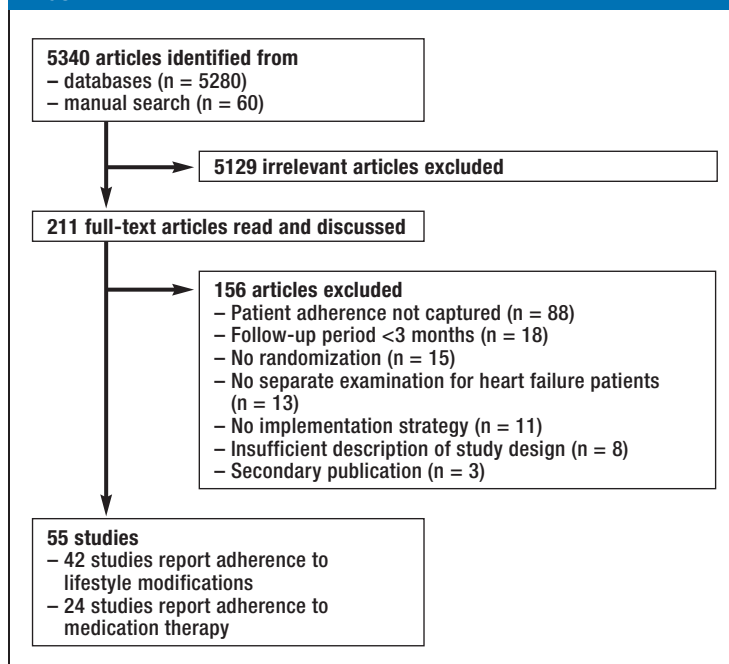
Patient reminder systems (22 studies)—These were based on regular telephone calls or home visits by specialized nursing staff, doctors' assistants, or pharmacists. Details of disease symptoms and adherence were recorded and discussed.

Support for self-care (32 studies)—This included all measures that enabled patients to better deal with their disorder, such as: independent use of measuring instruments, keeping a heart failure diary, schemes for diuretic adjustment, pill organizers, medication lists, or an advisory hotline.

Doctor-oriented interventions (11 studies)—In these, optimized or simplified therapeutic plans and suggestions for how to support patients were developed by pharmacists, nursing staff, or practice assistants; these were made available to treating physicians.

Organizational change (21 studies)—These concerned a restructuring of the tasks involved in caring for the patient during an inpatient stay and after discharge, between primary care physicians, cardiologists, psychologists, pharmacists, and nursing staff. Clinical investigations were undertaken—often by nursing staff—for the purpose of symptom monitoring and advice given on lifestyle modifications and diuretic adjustment.

FIGURE 1

5340 articles identified from
– databases (n = 5280)
– manual search (n = 60)

5129 irrelevant articles excluded

211 full-text articles read and discussed

156 articles excluded
– Patient adherence not captured (n = 88)
– Follow-up period <3 months (n = 18)
– No randomization (n = 15)
– No separate examination for heart failure patients (n = 13)
– No implementation strategy (n = 11)
– Insufficient description of study design (n = 8)
– Secondary publication (n = 3)

55 studies
– 42 studies report adherence to lifestyle modifications
– 24 studies report adherence to medication therapy

How the literature search was undertaken

Telemonitoring systems (13 studies)—These enabled measuring weight, blood pressure, heart rate, and automated prompting for adherence, symptoms, and awareness of medication therapy and lifestyle modifications, as well as direct control by nursing staff/ specialized teams.

Potential biases

The greatest restriction to study quality was unblinded self-reported adherence with a potentially high risk of bias in the direction of "desired behavior" (36 studies). Problems in generating randomization or blinded allocation could not be excluded in 23 and 39 studies, respectively. Further limitations resulted from the high rates of dropouts and from per-protocol analyses, which may bias effect sizes (19 studies), deviations between planned and reported endpoints (9 studies), and relevant differences between the intervention groups at the start of the study (14 studies). Publication bias cannot be excluded because negative treatment effects on adherence were rarely reported (*eFigure 1*, *eFigure 2*).

Efficacy of the interventions

Adherence to medication treatment—This was tested in 24 studies (*eTable 1*). Combining the treatment effects from 18 studies shows improved adherence in 10% (95% CI [5; 15]) (*Figure 2*) of patients by means of the intervention under study (number needed to treat [NNT] 10; 95% CI [7; 20]). It was not possible to calculate risk differences for six studies (e2, e10, e20,

FIGURE 2

Forest plot of the efficacy of interventions on the frequency of patients' adherence to medication therapy.
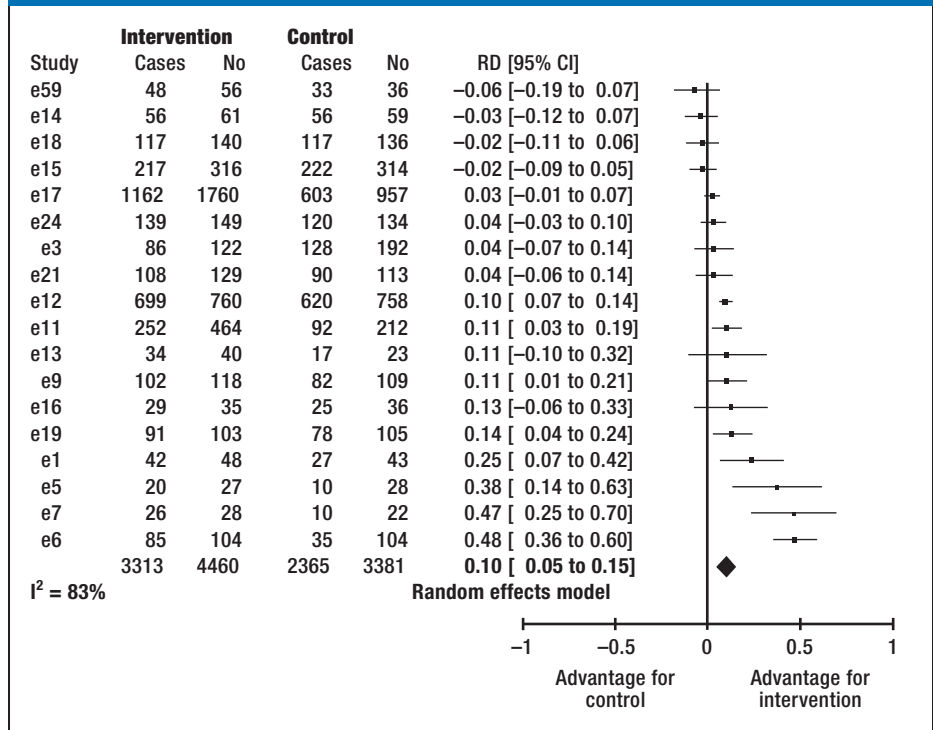
e22, e25, e26). None of these studies found improved adherence to medication intake.

Adherence to lifestyle recommendations—This was investigated in a total of 42 studies and improved in 31 studies *(eTable 2)*. The pooled effects of 22 studies in which adherence was calculated by using different summative scores (24, 25), showed improved adherence in the intervention groups in 12 studies *(Table)*. Improved adherence regarding individual recommendations was reported in 15 out of 18 further studies, with some studies reporting summative scores as well as adherence to individual recommendations. Five studies reported adherence by using different scores for which it was not possible to calculate any differences (e25, e28, e39, e44, e49). In four of these studies, adherence improved successfully.

Association between adherence and clinical parameters—44 studies had collected data on the efficacy of the interventions on clinical parameters (mortality, admission to hospital or quality of life). Improved adherence to medication therapy or lifestyle recommendations resulted in 6 and 11 studies, respectively, in significant improvements of at least one clinical endpoint *(eTable 3, eTable 4)*. Improved adherence to at least one of the studied recommendations resulted in the long term in an absolute reduction in mortality of 2 percentage points (95% CI [0; 4]) (17 studies including 6321 patients; *eFigure 3*) and a 10 percent reduction in the proportion of patients requiring inpatient stays (95% CI [3; 17]) (11 studies including 3368

patients; *eFigure 4*) within 12 months after the start of the intervention. Only one study investigated and confirmed an association between improved adherence to lifestyle interventions (keeping a heart failure diary) and lower mortality (e55). *eTable 5* summarizes all studies that did not find any improvement in clinical endpoints.

Discussion

Adherence to medication treatment as well as adherence to accompanying lifestyle recommendations can be improved by means of appropriate interventions. The effect sizes we found were lower than assumed, not least because of the pronounced heterogeneity of the included studies. Sustained effects can be expected especially for multimodal approaches that are provided with interactive feedback options for longer time periods.

Improved adherence to medication treatment
Approaches that entailed, among others, maintaining contact with patients for a lengthy period of time in order to practice adherent behaviors and check these were particularly effective *(eTable 3)*. Notably, such sustained effects were usually achieved independently of medical doctors—for example, by specially trained nursing staff, doctors' assistants (26–30), or pharmacists (29).

Moderately positive, but long-term, effects on quality of life, adherence to medication therapy, and

TABLE

Studies of the efficacy of interventions on patients' adherence to lifestyle modifications

A) EHFscBS and modifications

Study	Intervention			Control			
	Mean	SD	No	Mean	SD	No	SMD [95% CI]
e36	0.6	8.2	57	1.3	6.9	63	−0.09 [−0.45 to 0.27]
e27	106	21	9	108	22	9	−0.09 [−1.01 to 0.84]
e35	49.2	6.3	156	49.2	6.6	109	0.00 [−0.24 to 0.24]
e33	10.4	3.1	84	10.1	2.9	95	0.10 [−0.19 to 0.39]
e34	52.2	10.1	29	48.5	9	26	0.38 [-0.15 to 0.91]
e37	−21.2	6.4	65	−24.8	6.7	78	0.55 [0.21 to 0.88]
e24	−17.4	4.5	149	−20.8	5.8	134	0.66 [0.42 to 0.90]
e29	2.9	1	14	1.9	1.3	11	0.85 [0.02 to 1.68]
e31	12.1	10.9	76	3.1	10	75	0.86 [0.52 to 1.19]
e30	−27.1	2.5	47	−30.1	1.7	46	1.39 [0.93 to 1.84]
I² = 83% Random effects model			686			646	0.41 [0.30 to 0.52]

B] SCHFI and modifications

Study	Intervention			Control			
e42	159.2	46.3	27	178.4	29.6	26	−0.48 [−1.03 to 0.06]
e47	65.1	22.7	30	70	19.2	34	−0.23 [−0.72 to 0.26]
e40	2.6	0.67	37	2.2	0.67	39	0.59 [0.13 to 1.05]
e43	19.6	2.1	34	18	2.9	29	0.63 [0.12 to 1.14]
e38	12.4	1	45	10.8	0.9	34	1.65 [1.14 to 2.17]
e50	51.8	5.8	233	39.9	7.9	117	1.81 [1.55 to 2.07]
I² = 95% Random effects model			406			279	1.03 [0.86 to 1.20]

C) Further scores

Study	Intervention			Control			
e59	5.9	2.4	56	6.2	2.5	36	−0.12 [−0.54 to 0.30]
e48	6.1	2.1	40	5.8	1.9	47	0.15 [−0.27 to 0.57]
e24	54.9	6.5	149	52.3	8.9	134	0.34 [0.10 to 0.57]
e34	52.2	10.1	29	48.5	9	26	0.38 [−0.15 to 0.91]
e20	50.6	4.7	18	46.5	4.5	17	0.87 [0.17 to 1.57]
e51	35.9	2.73	108	32.74	3.53	108	1.00 [0.71 to 1.28]
I² = 81% Random effects model			400			368	0.46 [0.31 to 0.60]

EHFScBS, European Heart Failure Self-care Behaviour Scale; I², heterogeneity; CI, confidence interval; No, number of patients per group; SCHFI, self care heart failure index; SD, standard deviation; SMD, standardized mean difference (positive differences describe an advantage for the intervention)

self-care were shown as a result of complex bundles of measures (simplified dosing regimen, education for patients, brochures, keeping a heart failure diary with discussion of the documented entries) (29). Similarly, bundled interventions (telephone monitoring, smoking cessation courses, home visits in instability, advisory hotline) (27) had a positive effect on adherence to medication treatments and on mortality. The large GESICA study (which included 1518 patients) (28) showed that combined interventions had a sustained moderate success (telephone monitoring, information brochure, patient education provided by nursing staff,

and recommendations on adjusting medications and emergency admissions).

By contrast, no sustained effects were seen for approaches whose main focus was on educational/ training measures in hospital and included only very few contacts with patients for the extended observation period (for example, e3, e16, e49).

Our results therefore confirm the results of other review articles on the adherence to medication treatment: the long-term use of complex patient centered interventions is required for the intervention to be successful. However, this does not reach all patients, with

the result that altogether the effects on adherence and clinically important endpoints are rather small (31, 32).

Improved adherence to lifestyle modifications

We estimated the efficacy of interventions to improve adherence to lifestyle modifications in studies with very heterogeneous endpoints; summarizing the results is therefore difficult. What seems promising, however, is multidisciplinary cooperation with a combination of inpatient and outpatient care (*eTable 4*). This should include primarily patient education/training with individual treatment planning in hospital and subsequent regular outpatient contact, with repeated training sessions, medical histories, and examinations provided by non-doctor medical professionals (33–35). The efficacy of such measures can be supported by further interventions, such as:

- Care provided in a special clinic run by nursing staff (35)
- Structured telephone contact
- Medication adjustment by nursing staff after discussion with cardiologists
- Psychosocial care
- Help provided in a patient's domestic environment
- Creating a therapeutic bond that is based on trust.

Some studies (e33, e36) showed improved self-care at first follow-up, but they did now show any sustained improvements in results beyond the duration of the intervention. The therapeutic bond with a trusted professional—whether by telephone contact or home visit, or in the setting of a training/educational measure—obviously has a crucial role in improving adherence. A merely technically based solution without human interaction seems neither immediately effective nor able to provide a sustained effect (e23). In another study (e42) patients in the intervention groups were trained up as mentors, who were available to a particular assigned patient personally or by telephone whenever required. Although the implementation was linked to a person, self-care did not notably improve. The possible reason may be in the lack of competence that is perceived in a patient mentor—by contrast to medical personnel, encounters with whom a priori inspire a greater amount of confidence.

The efficacy of the collaboration of acute hospitals and rehabilitation facilities, and the formation of multidisciplinary networks in tertiary prevention of cardiovascular disorders was also emphasized by Labrunée et al (36).

Effect on clinical outcomes

The present review found that improved adherence was associated with additional positive effects on clinically relevant outcomes, which range from improved quality of life to reduced hospital stays to lower mortality. Further review articles have shown the lack of efficacy of patient training alone on clinical outcomes (37) and have shown the need for further patient centered measures in a patient's domestic environment, such as

structured telephone contacts and telemonitoring (38), or multidisciplinary care (39).

Limitations

One of the limitations of this study is the fact that on the one hand, certain groups—such as patients with depression or dementia syndromes—in whom the risk for lower adherence is particularly great, were excluded from many studies. On the other hand, the studies are probably representative for the group of patients requiring treatment with regard to age and disease severity.

This review includes exclusively strategies for the implementation of measures recommended these days, as the literature search was restricted to the time period starting after the year 2000. A bias to the observed treatment effects by selective publication of positive effects of the intervention on adherence cannot be excluded, especially in studies with primary clinical endpoints. The extensive heterogeneity of the described studies and the lack of objectivity in capturing adherence with the resulting heterogeneous treatment effects should be seen as a critical issue, so that the main result of this review is not the pooled treatment effects but the presentation and discussion of effective interventions.

Conclusion

In the practical implementation of adherence-promoting packages of measures, specialized nursing staff in hospitals, and specially trained doctors' assistants working in doctors' private practices are likely to have a crucial part in establishing such measures in a patient-centered way in future. Active participation of patients in the context of shared decision making (40) should form the basis for deciding on individual measures aiming to improve adherence. To this end, patients should be enabled—on the basis of comprehensible, evidence-based information tailored to them—to develop realistic expectations of their own disease course, and to be active and adopt individual responsibility in terms of dealing with their disease and treatment measures.

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@ **Supplementary material**
For eReferences please refer to:
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eTables, eFigures:
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Supplementary material to:

Improving Treatment Adherence in Heart Failure
A Systematic Review and Meta-analysis of Pharmacological and Lifestyle Interventions

by Susanne Unverzagt, Gabriele Meyer, Susanne Mittmann, Franziska-Antonia Samos, Malte Unverzagt, and Roland Prondzinsky

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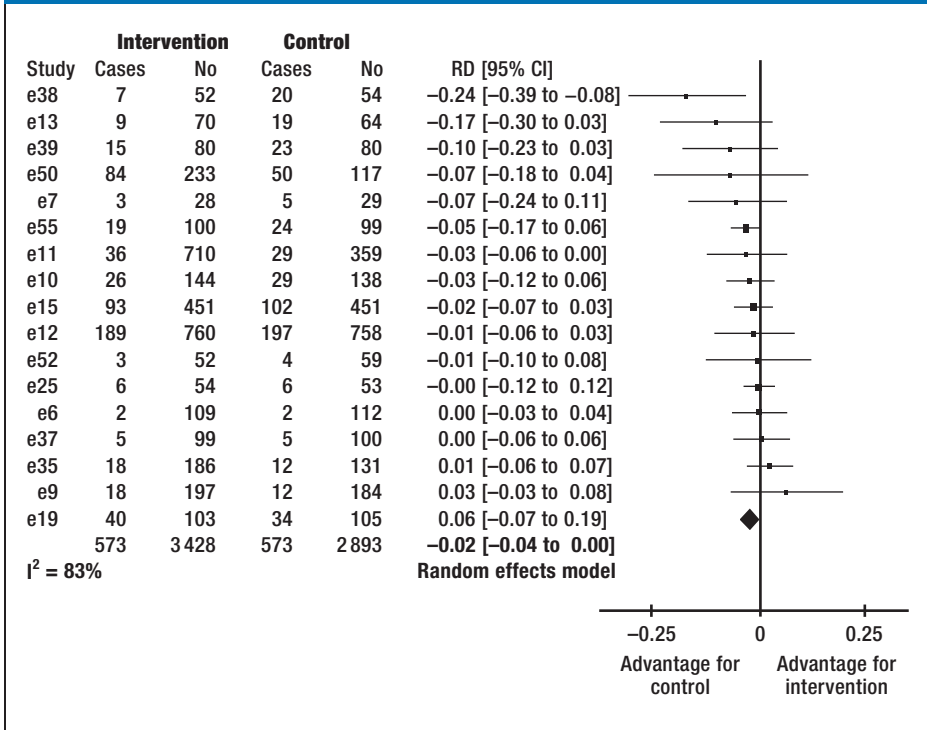
eFIGURE 1
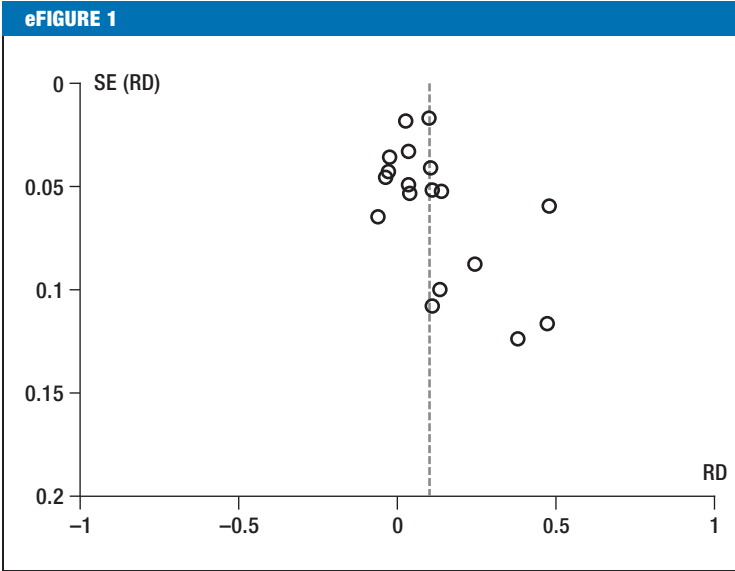
Funnel plot for intervention effects on adherence to medication therapies.
SE, standard error; RD, risk difference
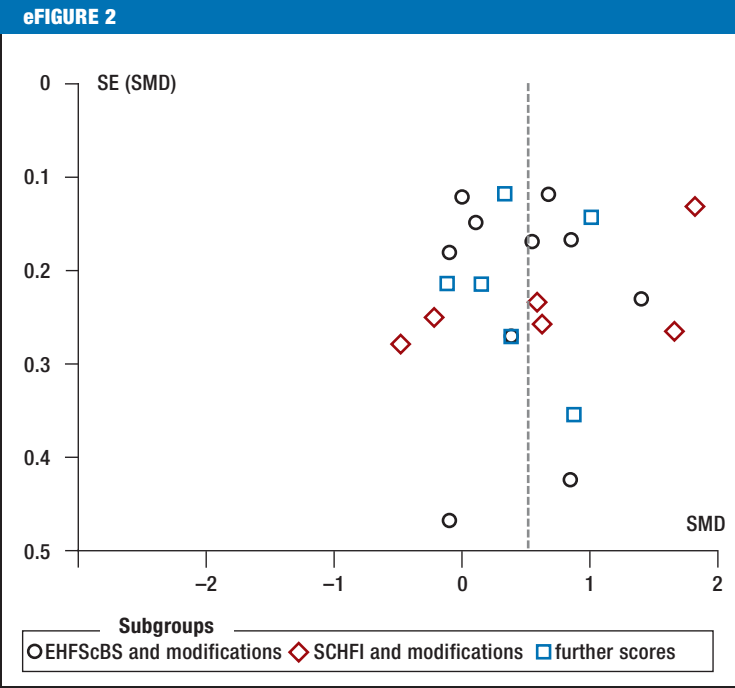
eFIGURE 2

Funnel plot for intervention effects on adherence to lifestyle recommendations.
EHFScBS, European Heart Failure Self-care Behaviour Scale; SCHFI, self care heart failure
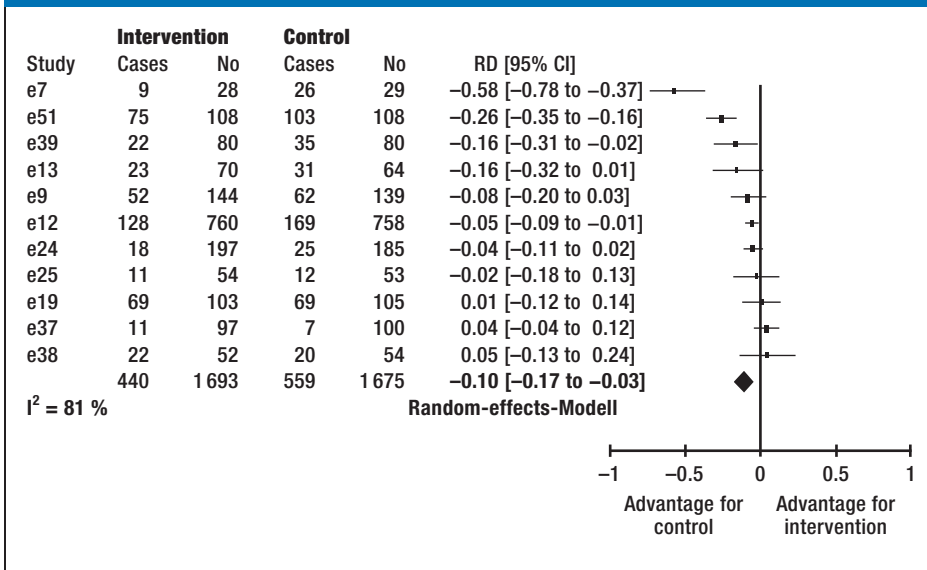index; SE, standard error; SMD, standardized mean difference

eFIGURE 3

	Intervention		Control		
Study	Cases	No	Cases	No	RD [95% CI]
e38	7	52	20	54	−0.24 [−0.39 to −0.08]
e13	9	70	19	64	−0.17 [−0.30 to 0.03]
e39	15	80	23	80	−0.10 [−0.23 to 0.03]
e50	84	233	50	117	−0.07 [−0.18 to 0.04]
e7	3	28	5	29	−0.07 [−0.24 to 0.11]
e55	19	100	24	99	−0.05 [−0.17 to 0.06]
e11	36	710	29	359	−0.03 [−0.06 to 0.00]
e10	26	144	29	138	−0.03 [−0.12 to 0.06]
e15	93	451	102	451	−0.02 [−0.07 to 0.03]
e12	189	760	197	758	−0.01 [−0.06 to 0.03]
e52	3	52	4	59	−0.01 [−0.10 to 0.08]
e25	6	54	6	53	−0.00 [−0.12 to 0.12]
e6	2	109	2	112	0.00 [−0.03 to 0.04]
e37	5	99	5	100	0.00 [−0.06 to 0.06]
e35	18	186	12	131	0.01 [−0.06 to 0.07]
e9	18	197	12	184	0.03 [−0.03 to 0.08]
e19	40	103	34	105	0.06 [−0.07 to 0.19]
	573	3 428	573	2 893	−0.02 [−0.04 to 0.00]
$I^2 = 83\%$					Random effects model

−0.25 0 0.25

Advantage for control   Advantage for intervention

Forest plot of the efficacy of interventions with improved adherence on mortality within 12 months.

I^2, heterogeneity
CI, confidence interval
No, number of patients
RD, risk difference

eFIGURE 4

	Intervention		Control		
Study	Cases	No	Cases	No	RD [95% CI]
e7	9	28	26	29	−0.58 [−0.78 to −0.37]
e51	75	108	103	108	−0.26 [−0.35 to −0.16]
e39	22	80	35	80	−0.16 [−0.31 to −0.02]
e13	23	70	31	64	−0.16 [−0.32 to 0.01]
e9	52	144	62	139	−0.08 [−0.20 to 0.03]
e12	128	760	169	758	−0.05 [−0.09 to −0.01]
e24	18	197	25	185	−0.04 [−0.11 to 0.02]
e25	11	54	12	53	−0.02 [−0.18 to 0.13]
e19	69	103	69	105	0.01 [−0.12 to 0.14]
e37	11	97	7	100	0.04 [−0.04 to 0.12]
e38	22	52	20	54	0.05 [−0.13 to 0.24]
	440	1 693	559	1 675	−0.10 [−0.17 to −0.03]
$I^2 = 81\%$					Random-effects-Modell

−1 −0.5 0 0.5 1

Advantage for control   Advantage for intervention

Forest plot of the efficacy of interventions with improved adherence on frequency of hospital inpatient admissions within 12 months.

I2, heterogeneity
CI, confidence interval
No, number of patients
RD, risk difference

eTABLE 1. Measurement of adherence to medications

Adherence to	Studies with maximal follow-up period (method)
Measurement over frequencies	
Prescribed medications	*6-9 Months*: e1 (MEMS), e2 (self-reporting), e3 (MEMS), e4 (self-reporting), e5 (MEMS) *≥ 12 Months*: e6, e7-e12 (self-reporting), e13 (tablet accountability method), e14 (self-reporting), e15 (MEMS)
Beta-Blockers	*3 Months*: e3 (MEMS) *≥ 12 Months*: e12, e14, e16, e17 (self-reporting)
ACE-inhibitors / ARB	*3 Months* : e3 (MEMS) *6-9 Months*: e18 (self-reporting) *≥ 12 Months*: e12, e14, e16, e19 (self-reporting)
Diuretica / spironolactone	*3 Months*: e3 (MEMS) *≥ 12 Months:* e12 (self-reporting)
MRA	*≥ 12 Months*: e14 (self-reporting)
Furoseminide	*≥ 12 Months*: e12 (self-reporting)
Measurement over scores	
Prescribed medications	*3 Months:* e20, e21 (self-reporting) *6-9 Months*: e22 (MARS) *≥ 12 Months*: e23 and e24, e25 (Morisky-Score), e26 (self-reporting)

MARS, medication adherence record scale; MEMS, medication event monitoring; MRA, mineralocorticoid receptor antagonist

eTABLE 2. Measurement of adherence to self-care management

Measurement tool	Studies with maximal follow-up period
Scores on multiple recommendations	
EHFScBS (13) and modifications*	*3 Months*: e27*-e29*, e30* *6-9 Months:* e31, e32, e33*, e34* *≥12 Months*: e24, e35-e37, e38*, e39
SCHFI (e42) and modifications*	*3 Months*: e40*, e41, e42,, e43*, e44* *6-9 Months*: e45*, e46*, e47
Further scores, developed for studies	*3 Months:* e6*, e20, e28, e48 *6-9 Months: e26, e47,* e49 *≥12 Months*: e25, e50*
Self-efficacy	*3 Months*: e20, e30, e51 *6-9 Months*: e4 *≥12 Months*: e15, e52
Single recommendations	
Daily weight and symptom control	*3 Months*: e21, e27, e53 *6-9 Months*: e54 *≥12 Months:* e10, e23; e52, e55
Restrictions to sodium intake	*3 Months*: e6, e20, e21, e56 *6-9 Months:* e2, e26, e57 *≥12 Months:* e10, e12, e15, e23
Restrictions to fluid intake	*3 Months:* e6, e21, e56 *≥12 Months:* e23
Exercise adherence	*3 Months:*e6, e20 *≥12 Months:* e10, e23
Smoking cessation adherence	*3 Months:*e20 *≥12 Months*: e23

EHFScBS, European Heart Failure Self Care Behaviour Scale; SCHFI, Self-Care of Heart Failure Index

***eTABELLE 3.* Studies with improved adherence to medications and improved clinical outcomes in the intervention group.**

Article	Study type recruitment	Population number, age, male, NYHA (I/II/III/IV), comorbidities	Comparison Intervention (IG) vs. control (CG)	Risk of bias (I/II/III/IV /V/VI)	Patient adherence (measurement, follow-up) IG vs. CG	Conclusions on primary outcome, clinical outcomes and adherence
Antonicelli 2010 (e7)	RCT Italy 16 months	57 hospitalized HF patients 78±7 years, 61% male NYHA: 0/58/37/5% Exclusion of patients with severe dementia, debilitating psychiatric disorders or chronic renal failure requiring dialysis	IG (n=28): • Reassessment of therapeutic regime on the basis of telemonitoring and telephone contacts • Training course for patients and caregivers in the hospital to use equipment CG (n=29): • similar course in the hospital on the importance of adherence	unclear/ unclear/ high/ low/ low/ low	Adherence to prescribed treatment: 12-months: 89.7 vs. 35.7%	Intervention can improve the composite endpoint of mortality and hospitalization and medication adherence (RD 0.47; 95%CI 0.25 to 0.70), but not mortality and quality of life.
Brotons 2009 (e9)	RCT Spain 01/2004 to 09/2005	283 hospitalized HF patients 76±8 years, 45% male NYHA 49/45/5/1% Diabetes: 42% Hypertension: 76% Exclusion of patients with a cognitive deficit	IG (n=144): • patient education in the hospital, booklet • monthly visits for one year (education, assessment of adherence to prescribed medications and lifestyle habits) • Nurses contacted the family physician or cardiologist when necessary • Contact per telephone every 15 days to evaluate clinical status by nurses CG (n=139): • referral to family physician and/or cardiologist	low/ low/ high/ low/ low/ low	Adherence to pharmacological treatment (high scores are better) 12-months: 86.1 vs. 75.5%.	Intervention can reduce mortality and hospital readmissions, improve QoL and medication adherence (RD 0.11; 95%CI 0.01 to 0.21).

Article	Study type recruitment	Population number, age, male, NYHA (I/II/III/IV), comorbidities	Comparison Intervention (IG) vs. control (CG)	Risk of bias (I/II/III/IV /V/VI)	Patient adherence (measurement, follow-up) IG vs. CG	Conclusions on primary outcome, clinical outcomes and adherence
Galbreath 2004 (e11)	RCT USA 1999 to 2003	1069 patients with HF symptoms identified through lists from partner institutions 71±10 years, 71% male NYHA: 19/57/21/3% Diabetes: 28% Hypertension: 72% Hyperlipidemia: 50%	IG (n=710): • Assignment of a disease manager and a specialized cardiac nurses • Telephone administration of a DM program (first weekly, later monthly over 18 months) • Mailed educational material • smoking cessation instructions • For instable patients contact to a nurse • Fax with a call summary to the primary physician • toll-free telephone number CG (n=359): • usual care by their physicians	unclear/ unclear/ unclear/ unclear/ low/ low	Adherence to guideline-based medications in systolic HF patients 18-months: 54.4 vs. 43.3%	Intervention can decrease mortality, but not event-free survival and improve longtime medication adherence (RD 0.11; 95%CI 0.03 to 0.19). –
GESICA 2005 (e12)	RCT Argentina 06/2000 to 11/2001	1518 ambulatory stable HF patients 65±13 years, 71% male NYHA III-IV: 49% Diabetes: 21% Hypertension:59% Exclusion of patients with primary pulmonary hypertension	IG (n=760): • education booklet • telephone follow-up by trained HF nurses (14-day frequency, later according to the needs over 12 months) with monitoring and education • nurses could adjust doses of diuretic or recommend non-scheduled medical or emergency visits CG (n=758): • followed by their attending cardiologist	low/ low/ unclear/ low/ high/ low	Adherence to medication and diet (mean follow-up of 16 months): beta-blocker: 59 vs. 52% spironolactone: 27 vs. 23% digoxin: 33 vs. 29% furosemide: 77 vs. 70% ACE-inhibitors: 78 vs. 76% Drug stop: 8 vs. 18%. dietary transgressions: 20 vs. 65%	Intervention can decrease mortality, readmissions and the probability of worsening HF and improve QoL and medication adherence (no drug stops of any drugs: RD 0.10; 95%CI 0.07 to 0.14 and diet: RD 0.45; 95%CI 0.40 to 0.49).

Article	Study type recruitment	Population number, age, male, NYHA (I/II/III/IV), comorbidities	Comparison Intervention (IG) vs. control (CG)	Risk of bias (I/II/III/IV /V/VI)	Patient adherence (measurement, follow-up) IG vs. CG	Conclusions on primary outcome, clinical outcomes and adherence
Sadik 2005 (e6)	RCT United Arab Emirates	221 HF patients from general medical wards and from cardiology and medical outpatient clinics 59 years, 50% male NYHA: 30/50/16/4% Diabetes: 18% Hypertension: 23% Exclusion of patients with low cognitive status	IG (n=109): • rationalization of therapy or simplification of dosage regimes by a research pharmacist and the physician • patient education, booklet • instructions on a self-monitoring program with a monitoring diary card • Discussion of the program by the research pharmacist and patient's physician CG (n=112): • usual care	low/ unclear/ high/ low/ low/ low	Compliance with the prescribed medicines: 12-months: 82 vs. 34% Lifestyle advice: baseline: 21 vs. 22% 12-months: 72 vs. 28%	Intervention can improve QoL and compliance to medications (RD 0.48; 95%CI 0.36 to 0.60) and lifestyle adjustments (RD 0.44; 95%CI 0.32 to 0.56) with no influence on mortality.
Wu 2012 (e5)	RCT USA	82 HF ambulatory and hospitalized patients 60±13 years, 57% male NYHA I-II/III-IV: 51/49% Charlson comorbidity index: 3.1±1.9 Exclusion of patients with impaired cognition	IG (n=54): • education of major caregiver s and patients by a cardiovascular nurse expert (weekly, 4 dates) • intensive group (n=27): additional feedback to medication-taking behavior CG (n=28): • usual care	unclear/ unclear/ low/ unclear/ low/ high	Medication taking adherence: baseline: 70 vs. 59 vs. 64% 9-months: 74 vs. 65 vs. 36%	Intervention improved event-free survival, hospitalization, but not mortality and QoL. Intervention can improve adherence in both intervention groups (RD 0.38; 95%CI 0.14 to 0.63 and RD 0.29; 95%CI 0.03 to 0.54).

CG, Control group; CI, confidence interval; DM, disease management; HF, heart failure; IG, intervention group; n, number of randomized participants; NYHA, New York Heart Association; QoL, Quality of life; RD, risk difference; RCT, randomized control trial;
RD>0 describe better adherence in IG
Risk of bias: I, random sequence generation; II, allocation concealment, III, blinding of outcome assessment; IV, incomplete outcome data; V: selective reporting; VI: other bias

eTABELLE 4. Studies with improved adherence to self-care management and improved clinical outcomes in the intervention group

Article	Study type recruitment	Population number, age, male, NYHA (I/II/III/IV), comorbidities	Comparison Intervention (IG) vs. control (CG)	Risk of bias (I/II/III/IV /V/VI)	Patient adherence (measurement, follow-up) IG vs. CG	Conclusions on primary outcome, clinical outcomes and patient's adherence
Benatar 2003 (e51)	RCT USA 04/1997 to 07/2000	216 hospitalized CHF patients 63±13 years, 37% male NYHA III or IV Diabetes: 23% Hypertension: 94% Exclusion of patients with renal failure or severe dementia or another debilitating psychiatric disorder	IG (n=108): • telephonic home monitoring devices to measured weight, blood pressure, heart rate, and oxygen saturation level with daily data transmission • an individual medical plan were developed by physicians and implemented by nurses • nurse evaluates patients' data, titrates medication therapies and educated patients to achieve the goals CG (n=108): • Home nurse visits	unclear/ unclear/ high/ low/ low/ low	Self-efficacy (higher scores are better): baseline: 32.0±3.1 vs. 31.0±4.5 3-months: 35.9±2.7 vs. 32.7±3.5	Intervention can decrease HF readmissions, length of hospital stay, costs and improve QoL and self-efficacy (MD 3.16; 95%CI 2.32 to 4.00).

Bocchi 2008 (e50)	RCT Brasilia 10/1999 to 01/2005	350 ambulatory CHF patients 51±17 years, 69% male NYHA 21/40/27/12% Diabetes: 17% Exclusion of patients with severe renal diseae	IG (n=223): • DMP delivered by nurses, cardiologists, pharmacists, social workers, dietitians, dentists, psychologists) • Face-to-face individual/group communication • Educations for patients and caregivers (4x in the first 6 months, repetitive at 6-months intervals) • Telephone in-person communication by HF-nurses (14-day frequency) CG (n=117): • usual care (standard follow-up by cardiologists)	low/ low/ low/ low/ low/ low	Adherence (higher scores are better): baseline: 30.8 ±11 vs. 36.4 ±9.9 up to 6 (mean 2.5±1.7) years: 51.8 ±5.8 vs. 39.9 ±7.9	Intervention can reduce unplanned hospitalization, hospital days, emergency care, mortality and improve QoL and self-care-adherence (MD 11.9; 95%CI 10.3 to 13.5).
Brandon 2009 (e28)	RCT USA	20 HF patients 60 (49 to 69) years, 45% male NYHA 25/50/20/5%	IG (n=10): • 7 telephone appointments (every 2 weeks) with patient education by an advanced practice nurse CG (n=10) • Usual care from the cardiologist clinic including education	unclear/ unclear/ unclear/ low/ unclear/ high	Self-care over the last 3 months (higher scores are better): Baseline: 95.9 vs. 94 6-months (3-months after the intervention): 128 vs. 94 (p<0.001).	Intervention can decrease hospital admissions and improve QoL and self-care behavior (MD 34).

Dansky 2009 (e54)	RCT USA started in 01/2006	108 CHF patients, discharged from Medicare-certified home-health agencies 78 (22-98) years	Use of a telehealth-based disease management system in the hospital IG (n=64): • use of the telehealth system under supervision of medicare-certified home health agencies over 6 months following discharge from formal health services CG (n=44): • No further telehealth or home health services	unclear/ unclear/ high/ high/ unclear/ high	Self-management (weight control): 6-months: 86.7% vs. 50%	Intervention can decrease hospitalizations and emergency department visits and improve QoL. It can increase the frequency of patients who measured daily their weight (RD 0.37; 95% CI 0.17 to 0.57).
DeWalt 2006 (e52)	RCT USA 11/2001 to 04/2003	127 HF patients from the General Internal Medicine and Cardiology Practices at a university hospital 62±10 years, 49% male NYHA: 0/50/46/4 Diabetes: 55% Hypertension: 88% Exclusion of patients with dementia or on dialysis	IG (n=62): • Delivered in the General Internal Medicine Practice • Educational session (1-hour) with a clinical pharmacist or a health educator on the basis of an educational booklet for low literacy patients • Self-management of weight fluctuations and diuretic dosages • Scheduled follow-up telephone calls (days 3,7,14,21,28,56, monthly during months 3-6) with feedback to reinforce the educational session CG (n=65): • General HF education pamphlet	low/ low/ high/ low/ low/ high	HF self-efficacy (higher scores are better): 12 months: MD 2 (95%CI 0.7 to 3.1) Daily weighting: 79 vs. 29%.	Intervention can decrease hospitalization or deaths with no influence on mortality and QoL. It can improve self-efficacy and the frequency of daily weighting (RD 0.50; 95%CI 0.34 to 0.66).

| Kasper 2002 (e2) | RCT USA 12/1996 to 12/1998 | 200 hospitalized CHF patients at high risk of hospital readmission

62±14 years, 60% male
NYHA II/III: 36/58%
Diabetes: 40%
Hypertension: 67%

Exclusion of patients with psychiatric disease or dementia | IG (n=102):
• Telephone calls (within 72 h of hospital discharge, weekly, later monthly over 6 months)
• Monthly follow-up visits with the CHF nurse: adjusted medication under the direction of CHF cardiologists, recommendation of a sodium-restricted diet, exercise to walk
• Individualized treatment plans
• Weekly meeting of nurses and cardiologists
• Financial support of patients on diet, transportation or telephone
• Patients were supplied a pill sorter, a list of correct medications, a list of lifestyle recommendations, a contact number and educational material

CG (n=98):
• Usual care by primary physicians | low/ low/ high/ low/ low /low | Good or average compliance with dietary recommendations:
6-months: 69 vs. 45%,
Medication compliance: no differences (not shown) | Intervention might reduce readmissions and mortality. It can improve QoL and compliance to dietary recommendations RD 0.24; 95%CI 0.10 to 0.39), but did not influence medication compliance.
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| Korajkic 2011 (e53) | RCT Australia 02/2008 to 10/2008 | 70 HF patients presenting at a referral outpatient clinic

57±12 years, 77% male
NYHA: 0/72/27/1%
Diabetes: 16%
Hypertension: 44%
Hypercholesterinaemia: 51%

Exclusion of patients with baseline renal impairement (serum creatinine concentration > 200 µmol/L or on dialysis), severe psychiatric illness or moderate to severe dementia | IG (n=35):
• Educational session during the clinic appointment with a pharmacist (30 min) to use instructions to daily assess symptoms of fluid retention, weight change and adjust frusemide dose
• Self-adjustment of diuretic doses

CG (n=35):
• No self-adjustment, patient called a HF nurse to discuss diuretic doses | low/ unclear/ low/ low/ low/ low | patients with appropriate weight-titrated furosemide dose adjustments:
3-months: 80% vs. 51% | The intervention can improve the ability of HF patients to self-adjust their diuretic dose by a flexible dosing regime (RD 0.29; 95% CI 0.07-0.50) and might reduce readmissions and QoL. |

Shao 2013 (e30)	RCT Taiwan 10/2006 to 01/2007	108 hospitalized CHF patients 72±6 years, 68% male NYHA: 7/66/27/0% number of co-morbidities: 3.8±0.8 Exclusion of patients with renal failure or debilitating psychiatric disorder	IG_(n=54): • Designed to enhance self-management by • Home visits within 3 days after enrolment • Telephone follow-ups at 1,3,7, and 11 weeks • Dairy of daily sodium and fluid intake and self-recording of weight CG (n=54): • Usual care from clinical nurses during the patient's hospital admission with education, differing telephone calls (at 3, 7 und 11 weeks) from the research assistant	low/ low/ high/ low/ low/ low	Self-efficacy for salt and fluid control (higher scores are better): baseline: 41.6±10.2 vs. 43.6±10.3 3-months: 50.8±5.4 vs. 42.9±8.1 Self-care (modified EHFscBS): baseline: 29.2±3.7 vs. 29.2±3.3 3-months: 27.1±2.5 vs. 30.1±1.7	Intervention can improve self-efficacy for salt and fluid control (MD 7.9; 95%CI 5.1 to 10.7), self-care (MD 3.0; 95%CI 2.1 to 3.9) and HF-related symptoms.

Strömberg 2003 (e38)	RCT Sweden 06/1997 to 12/1999	106 hospitalized HF patients 78±7 years, 61 % male NYHA: 0/18/71/11% Diabetes: 24% Hypertension: 40% Exclusion of patients with dementia or other psychiatric illness	IG (n=52): • Follow-up at a nurse-led HF clinic staffed by specially educated experienced cardiac nurses • First visit 2-3 weeks after discharge, visits lasted 1 h • Nurses evaluated status, individualized education about HF and self-care • social support to patients and their families • If treatment needed optimized, cardiologist was consulted and changed treatment • Patients could contact nurses during daily telephone hours CG (n=54): • Conventional follow-up in primary health care	low/ low/ high/ high/ low/ high	Self-care change from baseline to 12 months follow-up (higher scores are better): 2.3 vs. 0.5 (p=0.01)	– Follow-up in a nurse-led HF clinic can improve survival, reduce hospital admissions and improve self-care (MD 1.6; 95%CI 1.2 to 2.0).
Wierzchowiecki 2006 (e39)	RCT Poland	160 hospitalized CHF patients 68±10 years, 59% male NYHA: 0/14/47/39% Diabetes: 28% Hypertension: 48%	IG (n=80): • Multidisciplinary care on follow-up visits at the HF- clinic (after 14 days, 1,3,6, 12 months) by the cardiologist, the HF nurse, a physiotherapist and psychologist • Opportunity of telephone counselling by the HF nurse and cardiologist CG (n=80): • Usual care by their primary care physicians	unclear/ unclear/ high/ unclear/ low/ high	Self-care (EHFscBS): 12-months (lower scores are better): 19.5 (IQR 16 to 24) vs. 42 (IQR 37 to 47) (p<0.001)	Intervention can decrease the frequency of readmissions, length of hospital stay, mortality, improve QoL and self-care (MD 22.2).

Wright 2003 (e55, e60)	RCT New Zealand 1996 to 1997	197 hospitalized HF patients due to first diagnosis or exacerbation 73±11 years, 60% male NYHA I-II/III : 93/7% Diabetes: 29% Treated hypertension: 52%	IG (n=100): • Out-patient clinical review (within 2 weeks of discharge followed by 6-weekly visits over 12 months) with • One-on-one patient counselling and education by specialized HF nurses • Optimization of medical therapy by a HF physician • Liaison with the patient's family and the primary health care providers • HF diary to monitor and manage weight changes on the basis of an individualized action plan • Three group education sessions CG (n=97): • Usual post-discharge care (mainly by as-needed primary-care consultations)	low/ unclear/ high/ low/ low/ low	Self-weighting: 12 months: 87 vs. 29%	Intervention had no influence on the combined endpoint of hospital readmission and death despite improved QoL and slightly lower mortality. It increased number of patients who used self-weighting (RD 0.29; 95%CI 0.03 to 0.54).

CG, Control group; CI, confidence interval; DM, disease management; EHFscBS, European Heart Failure Self-care behavior scale; HF, heart failure; IG, intervention group; IQR: inter-quartile-range; n, number of randomized participants; MD: mean difference; NYHA, New York Heart Association; QoL, Quality of life; RD, risk difference; RCT, randomized control trial;

MD, RD>0 describe better adherence in IG

Risk of bias: I, random sequence generation; II, allocation concealment, III, blinding of outcome assessment; IV, incomplete outcome data; V: selective reporting; VI: other bias

eTABELLE 5. Studies with no improvement of adherence and clinical outcomes in the intervention group

Article	Study type recruitment	Population number, age, male, NYHA (I/II/III/IV), comorbidities	Comparison Intervention (IG) vs. control (CG)	Risk of bias (I/II/III/IV/ V/VI)	Patient adherence (measurement, follow-up) IG vs. CG	Conclusions on primary outcome, clinical outcomes and patient's adherence
Agren 2010 (e36)	RCT Sweden 01/2005 to 12/2008	155 recently discharged HF patients after a acute exacerbation 71±11 years, 75% male NYHA: /32/53/15% Diabetes: 12% Hypertension: 34% Exclusion of patients with dementia or severe psychiatric illnesses	IG (n=84): • Nurse-led face-to-face counseling, • Computer-based CD-ROM and other written teaching material • Education in the dyad's home or in the HF-clinic (2, 6 and 12 weeks after discharge, duration ≥ 60 min) CG (n=71): • Usual care without systematic involvement of the partner	low/ unclear/ high/ high/ low/ high	Self-care (EHFscBS) change to baseline: 3-months: 3.1 ± 6.3 vs. 2.0 ± 6,9 12-months: 0.6 ± 8.2 vs. 1.3 ± 6.9	Intervention initially improved patients' level of perceived control with no effect on long-term self-care (MD-0.70; 95%CI -2.03 to-3.43) and QoL.
Albert 2007 (e40)	RCT USA 05/2000 to 07/2002	112 hospitalized HF patients after an acute decompensation 60±14 years, 77% male Diabetes: 33% Hypertension: 54% Hyperlipidemia: 46% Renal insufficiency: 34% Exclusion of mentally not alert patients	IG (n=59): • Standard education and HF video on self-care behaviors and self-management (60 minutes) CG (n=53): • Standard education by a variety of healthcare providers	high/ low/ high/ low/ unclear/ low	Self-care (SCHFI): 3-months: 2.6 vs. 2.2 (p=0.01)	Intervention did not influence healthcare utilization (including hospitalization) and the number of HF-symptoms, but it can improve self-care behavior (MD 0.4; 95%CI 0.1 to 0.7).

Article	Study type recruitment	Population number, age, male, NYHA (I/II/III/IV), comorbidities	Comparison Intervention (IG) vs. control (CG)	Risk of bias (I/II/III/IV/ V/VI)	Patient adherence (measurement, follow-up) IG vs. CG	Conclusions on primary outcome, clinical outcomes and patient's adherence
Arcand 2005 (e56)	RCT Canada –	47 stable HF patients from an ambulatory HF clinic 58±3 years, 74% male Exclusion of patients with diabetes requiring insulin or severe renal dysfunction	IG (n=23): • Nutrition educational package • Nutrition education provided by dietitians at the hospital (two sessions over 30- 45 minutes) CG (n=24): • Nutrition educational material	unclear/ unclear/ high/ low/ low/ unclear	Sodium intake (g/d): baseline: 2.80±1.47 vs. 3.00±1.52 3-months: 2.14±1.13 vs. 2.74±1.68 fluid intake (1.88L/d): baseline: 1.86±0.54 vs. 2.26±1.01 3-months: 1.88±0.64 vs. 2.02±0.72	Intervention might reduce sodium and fluid intake (MD 0.60; 95%CI -0.22 to 1.42 and 0.14; 95%CI -0.25 to 0.53).

Article	Study type recruitment	Population number, age, male, NYHA (I/II/III/IV), comorbidities	Comparison Intervention (IG) vs. control (CG)	Risk of bias (I/II/III/IV/ V/VI)	Patient adherence (measurement, follow-up) IG vs. CG	Conclusions on primary outcome, clinical outcomes and patient's adherence
Artinian 2003 (e27)	RCT USA	18 scheduled HF patients 68±11 years, 94% male NYHA: 0/39/50/11% Exclusion of patients with dementia, mental illnesses or hemodialysis	Educational booklet on HF self-care behavior IG (n=9): • Usual care • Remind patients Med-eMonitor (retains a supply of up to 5 medications in individual compartments and uses an alarm to daily take the correct number of drugs) • Daily tailored reminders and questions about other medications and self-management activities • Daily transmissions of patient's information and changes of their regime to the Med-eMonitor server CG (n=9): • Usual care • Visits to the cardiologist in the HF clinic with assessment of medication-taking	low/ unclear/ high/ low/ high/ unclear	Self-Care (revised SCB): baseline: 92±8 vs. 95±22 3-months: 106±21 vs. 108±22 compliance to daily weight monitoring: 3-months: 85 vs. 79% blood pressure monitoring: 3-months: 81 vs. 51%	Intervention did not improve self-care behavior (MD -2; 95%CI -22 to 18) and might improve compliance to daily weighting (RD 0.08; 95%CI -0.30 to 0.45) and blood pressure monitoring with no influence on QoL.

Article	Study type recruit ment	Population number, age, male, NYHA (I/II/III/IV), comorbidities	Comparison Intervention (IG) vs. control (CG)	Risk of bias (I/II/III/IV/ V/VI)	Patient adherence (measurement, follow-up) IG vs. CG	Conclusions on primary outcome, clinical outcomes and patient's adherence
Balk 2008 (e32)	RCT Netherla nds 07/2005 to 08/2006	214 stable HF patients 66 (33-87) years, 70% male NYHA 7 /41/50/2% Diabetes: 31% Hypertension 33%	IG (n=101): • Home TV-channel with education and reminders to medications in addition to follow-up by cardiologists • Patients with hospital admissions during the last year receive automatic devices for daily measurement of blood pressure and weight • Tele-guidance and monitoring of daily measurements by HF-nurses on the basis of a personalized plan from the cardiologist CG (n=113): • Follow-up by cardiologists and HF-nurses	unclear/ low/ high/ high/ high/ high	Self-Care (EHFscBS): no differences at the end of the study (mean follow-up 288 days, data not reported)	Intervention did not reduce mortality and the numbers of days in hospital and had no effect on QoL and self-care behavior.

Article	Study type recruit ment	Population number, age, male, NYHA (I/II/III/IV), comorbidities	Comparison Intervention (IG) vs. control (CG)	Risk of bias (I/II/III/IV/ V/VI)	Patient adherence (measurement, follow-up) IG vs. CG	Conclusions on primary outcome, clinical outcomes and patient's adherence
Barnason 2003 (e20)	RCT USA	35 ischemic hospitalized HF CABG patients 73±5 years, 69% male NYHA I to II	IG (n=18): • Tele-medicine via the patient's telephone for communication and assessment of symptoms, education and positive reinforcement and patient education • Patients had to respond to questions on their health status and CABG-recovery information (daily sessions for 6 weeks) • Research nurses reviewed responses to insure appropriate sessions Control group (n=17): • Usual patient education and counselling prior to hospital discharge	unclear/ unclear/ high/ unclear/ unclear/ unclear	Cardiovascular Risk Factor Modification Adherence (4=always adhere) at 3-months: exercise: 4.0±0.0 vs. 3.4±0.86 diet: 3.4±0.89 vs. 3.2±0.75 stress reduction: 4.0±0.0 vs. 3.3±0.77 medication use/ Tobacco cessation: 4.0±0.0 vs. 4.0±0.0 Summary score not reported self-efficacy (higher scores are better): baseline: 43.2±9.5 vs. 43±6.4 3-months: 50.6±4.7 vs. 6.5±4.5	Intervention can improve self-efficacy (MD 4.10; 95%CI 3.37 to 4.83) and some components of QoL compared with usual care with no influence on lifestyle and medication adherence.

Article	Study type recruitment	Population number, age, male, NYHA (I/II/III/IV), comorbidities	Comparison Intervention (IG) vs. control (CG)	Risk of bias (I/II/III/IV/V/VI)	Patient adherence (measurement, follow-up) IG vs. CG	Conclusions on primary outcome, clinical outcomes and patient's adherence
Bouvy 2003 (e1)	RCT Netherlands 07/1998 to 02/2000	152 HF patients in a hospital or attending a HF outpatient clinic 70±11 years, 66% male NYHA 10/42/44/4% Diabetes: 28% Hypertension: 40% Renal Insufficiency: 13% Exclusion of patients with dementia or severe psychiatric problems	IG (n=74): • Patient's pharmacists received training for a structured interview on the patient's first visit to the community pharmacy • Use of a computerized medication history for a discussion of drug use, reasons for non-compliance • General physician receives a summary of this interview • Monthly patient contact by the pharmacist (maximal 6 months) CG (n= 78): • Usual care	low/ unclear/ low/ high/ low/ low	Medication compliance over the time (>95% compliance): up to 6 months: 87% vs. 63%	Intervention can improve medication compliance (RD 0.25; 95%CI 0.07 to 0.42) with no influence on QoL, readmissions and mortality. –

Article	Study type recruitment	Population number, age, male, NYHA (I/II/III/IV), comorbidities	Comparison Intervention (IG) vs. control (CG)	Risk of bias (I/II/III/IV/ V/VI)	Patient adherence (measurement, follow-up) IG vs. CG	Conclusions on primary outcome, clinical outcomes and patient's adherence
Bowles 2010 (e45)	RCT USA	218 hospitalized HF patients 72±10 years, 36% male 6.8±4 number of co-morbidities Exclusion of mentally not competent patients	IG: • Telehomecare in patients home (video phone, wireless peripheral devices) • Patients were allowed to measure alone, measurements readable for patients and transmitted directly to the home health nurse • Nurses and patients interacted via video phone (at least 4 visits were planned) CG: • Usual care with skilled nursing visits per week (1-3 visits per week for up to 8 weeks depending on patient need)	unclear/ unclear/ low/ high/ high/ unclear	Self-care (SCHFI): 6-months: maintenance: 57±4 to 72±19 management 48±26 to 64±24	Both groups improved self-care and reached adequate levels with no differences between groups. Intervention might reduce readmissions.

Article	Study type recruitment	Population number, age, male, NYHA (I/II/III/IV), comorbidities	Comparison Intervention (IG) vs. control (CG)	Risk of bias (I/II/III/IV/V/VI)	Patient adherence (measurement, follow-up) IG vs. CG	Conclusions on primary outcome, clinical outcomes and patient's adherence
Boyne 2012 & 2014 (e23, e24)	RCT Netherlands 10/2007 to 12/2008	382 scheduled HF patients 71±11 years, 59% male NYHA 0/57/40/3% Exclusion of patients with hemodialysis or (pre)dementia	IG (n=187): • telemonitoring with daily pre-set dialogues about symptoms, knowledge and behavior with automatic corrections between patients and nurses • responses were transferred into risk profiles (low, medium, high) • immediate response of the nurse on symptoms • after 3 months dialogues were adjusted to the current individual risk profile CG (n=185): • nurse-led usual care including oral and written educational information and psychological support	low/ unclear/ high/ high/ low/ low	Self-care (EHFscBS): baseline: 18.9±5.3 vs. 20.9±6.1 12-months: 17.4±4.5 vs. 20.8±5.7 Self-efficacy: baseline: 53.2±7.1 vs. 51.1±9.6 12-months: 54.9±6.5 vs. 52.3±8.9 HF compliance scale at 12 months: medications: 93.5 vs. 89.8 weighting: 75.4 vs. 61.3 diet: 73.8 vs. 69.9 fluid: 76.5 vs.68.6 activities: 63.8 vs. 62.8 and appointments, smoking, alcohol	Intervention can increase mean time to first HF-related hospitalization and decrease number of hospitalization with no effect on mortality, can improve self-care (MD -3.4; 95%CI -4.6 to -2.2) and might improve self-efficacy (MD 1.18; p=0.192) and HF compliance.

Article	Study type recruitment	Population number, age, male, NYHA (I/II/III/IV), comorbidities	Comparison Intervention (IG) vs. control (CG)	Risk of bias (I/II/III/IV/V/VI)	Patient adherence (measurement, follow-up) IG vs. CG	Conclusions on primary outcome, clinical outcomes and patient's adherence
Caldwell 2005 (e29)	RCT USA	36 stable HF patients from a cardiology practice 71±15 years, 69% male NYHA I-IV Exclusion of patients with a neurological disorder that impaired cognition	IG (n=20): • One-on-one education and counseling session by a non-cardiac trained nurse • Phone-call at one month to reinforce education and symptom recognition • Written take-home information, weight dairy with a list of symptoms and actions CG (n=16): • Usual care • Printed brochure on symptom recognition and self-management	unclear/ unclear/ unclear/ low/ unclear/ high	Self-care (abbreviated EHFscBS) baseline: 1.6±0.9 vs. 1.5 ±0.8 3-months: 2.9±1.0 (better) vs. 1.9±1.3	Intervention can improve knowledge and self-care behavior (MD 1.0; 95%CI 0.05 to 1.93).

Article	Study type recruitment	Population number, age, male, NYHA (I/II/III/IV), comorbidities	Comparison Intervention (IG) vs. control (CG)	Risk of bias (I/II/III/IV/ V/VI)	Patient adherence (measurement, follow-up) IG vs. CG	Conclusions on primary outcome, clinical outcomes and patient's adherence
Copeland 2010 (e10)	RCT USA 06/2005 to 12/2005	458 HF hospitalized or frequently treated ambulant patients from the Veterans Health Administration (VA) 70±11 years, 100% male Diabetes: 54% Hypertension: 81% Exclusion of patients with severe dementia or on dialysis	IG (n=220): • Creation of a patient-specific self-management plan using the primary care physician's self-management plan • Scheduled telephone interactions including education and coaching by DM nurses to improve self-management (30-40 min, frequency depending on risk profile) • Access to nurse advice line for symptoms and counselling (24 hours a day, 7 days a week) • Medication compliance and vaccination reminders, workbooks, post-assessment letters • Information of the patient's physician about signs and symptoms of decompensation and non-adherence (fax, electronic medical record system) Control group (n= 238): Usual care	high/ unclear/ unclear/ high/ high/ low	Compliance to self-care at 12 months: check weight daily: OR 1.94; 95%CI 1.06 to 3.55 exercise: OR 1.94; 95%CI 1.08 to 3.49 recommended diet: OR 1.29; 95%CI 0.72 to 2.29 medications: OR 0.59; 95%CI 0.20 to 1.73.	Intervention resulted in no differences in clinical outcomes (QoL, readmissions, mortality) with higher costs in the intervention group and improved compliance to 2 of 4 self-care-recommendations.

Article	Study type recruitment	Population number, age, male, NYHA (I/II/III/IV), comorbidities	Comparison Intervention (IG) vs. control (CG)	Risk of bias (I/II/III/IV/ V/VI)	Patient adherence (measurement, follow-up) IG vs. CG	Conclusions on primary outcome, clinical outcomes and patient's adherence
Domingues 2011 (e48)	RCT Brasilia 01/2005 to 07/2008	120 hospitalized patients with decompensated HF 63±13 years, 68% male Exclusion of patients with cognitive neurological sequelae	In-hospital nursing education (5 visits, 30-60 min) for patients and caregivers, weight chart IG (n=57): • telephone monitoring after discharge over 3 months (8 calls) by a nurse to reinforce instructions and monitor symptoms CG (n=63): • follow-up at the outpatient clinic	unclear/ unclear/ high/ high/ low/ low	HF awareness and self-care knowledge score: baseline: 4.6±1.9 vs. 4.5±1.9 3-months: 6.1±2.1 vs. 5.8±1.9	Intervention might improve awareness and self-care knowledge (MD 0.30; -0.55 to 1.15), but did not decrease mortality and hospitalizations.
Holland 2007 (e22)	RCT United Kingdom 12/2003 to 03/2005	339 hospitalized HF patients due to emergency issues 77±9 years, 63% male NYHA: 6/27/34/33%	IG (n=169): • Study pharmacists were provided with a copy of the patient's discharge letter • Home visit of the pharmacist with the patient and any caregivers with education and advice (within 2 weeks and 6 to 8 weeks after discharge), booklet • Encouraged symptom monitoring diaries, removed discontinued drugs • Feedback to local pharmacist to the general practitioner and local pharmacist for a drug adherence aid CG (n=170): • Usual care	low/ low/ high/ high/ low/ low	Drug adherence (MARS score): baseline: 23.8 vs. 23.6 6-months: 23.7 vs. 23.6	Intervention had no effects on mortality, readmissions, QoL and medication adherence scores (MD 0.12; 95% CI -0.48 to 0.73).

Article	Study type recruitment	Population number, age, male, NYHA (I/II/III/IV), comorbidities	Comparison Intervention (IG) vs. control (CG)	Risk of bias (I/II/III/IV/ V/VI)	Patient adherence (measurement, follow-up) IG vs. CG	Conclusions on primary outcome, clinical outcomes and patient's adherence
Israel 2013 (e16)	RCT USA enrollment through 06/2012	732 CVD patients (108 with HF) admitted to the internal medicine, family medicine, cardiology or orthopedics service ≥18 years, 38% male Hypertension: 75% Hyperlipidemia: 61% Exclusion of patients with dementia, cognitive impairment or severe psychiatric or psychosocial disorders	IG (n=486, 142 with HF): • Comprehensive medication reconciliations, identification of drug problems (within 24 hours of admission) by a pharmacy case managers • Recommendations to the inpatient care team and outpatient primary care physician to optimize therapy • Patient education (every one or two days during admission, on discharge) • Enhanced intervention group: discharge care plan was faxed to the patient's primary care physician • Follow-up telephone call from the pharmacist to the patient (3 to 5 days after hospital discharge) CG (n= 246, 66 with HF): Usual care with discharge medication list and oral information from a hospital unit nurse	low/ unclear/ low/ unclear/ low/ high	Underutilization of HF drugs 3-months: ACEI or ARB: 17.1 vs. 29.7 vs. 30.6% β-blockers: 20.0 vs. 21.6 vs. 19.4%	Intervention had no effect on the underutilization of ACEI or ARB (enhanced IG vs. CG: RD 0.13; 95%CI -0.06 to 0.33, minimal IG vs. CG: RD 0.01; 95%CI -0.20 to 0.22) and β-blockers (enhanced IG vs. CG: RD -0.01; 95%CI -0.19 to 0.18, minimal IG vs. CG: RD -0.02; 95%CI -0.21 to 0.16).

Article	Study type recruitment	Population number, age, male, NYHA (I/II/III/IV), comorbidities	Comparison Intervention (IG) vs. control (CG)	Risk of bias (I/II/III/IV/ V/VI)	Patient adherence (measurement, follow-up) IG vs. CG	Conclusions on primary outcome, clinical outcomes and patient's adherence
Jaarsma 2000 (e33)	RCT Netherlands 05/1994 to 03/1997	186 hospitalized HF patients 72±9 years, 60% male NYHA III/III-IV/IV: 17/22/61% Diabetes: 32% Hypertension:25% Exclusion of patients with a psychiatric diagnosis	IG (n=89): • Intensive structured individualized education by a study nurse (approximately 4 visits in the hospital, 1 telephone call, 1 home visit) • Information of the home care nurse about specific needs Control group (n=97): • Standard care and education	unclear/ unclear/ high/ low/ low/ unclear	Self-care (modified SCB scale): baseline: 8.9±3.0 vs. 9.5±3.0 3-months: 11.6±3.1 vs. 10.2±3.3 9- months: 10.4±3.1 vs. 10.1±2.9.	Intervention can improve self-care behavior over a short time, but not over a longer follow-up (MD0.3; 95%CI -0.058 to -1.18), might be successful in improving QoL, but did not reduce mortality.
Jurgens 2013 (e41)	RCT USA	105 HF patients admitted to the hospital, referred from community health care providers or recruited with advertisements 68±12 years, 68% male NYHA I-II/III/IV: 15/48/37% Exclusion of patients with major diagnosed psychiatric illness	Weight-scales, HF-self-care booklet written at the 6th to 8th grade level IG (n=53): • Additional education on how to recognize and response to symptoms (4 times) • Home visit (7 to 10 days after discharge) to review symptom training CG (n=52): • Usual care	low/ unclear/ unclear/ low/ low/ low	Self-Care (SCHFI) Maintenance: baseline 56.8±22.0 vs.57.5±24.0 3-months:76.9±18.4 vs. 70.8±21.2 Management: baseline: 48.2±19.3 vs. 43.8±21.1 3-months: 60.4±27.2 vs.61.1±22.5	Intervention had no influence on mortality, readmissions and self-care management (MD -0.7; 95%CI -0.7; -10.6 to 9.1) and might improve self-care maintenance (MD 6.1; 95%CI -1.7 to 13.9).

Article	Study type recruitment	Population number, age, male, NYHA (I/II/III/IV), comorbidities	Comparison Intervention (IG) vs. control (CG)	Risk of bias (I/II/III/IV/V/VI)	Patient adherence (measurement, follow-up) IG vs. CG	Conclusions on primary outcome, clinical outcomes and patient's adherence
LaPointe 2006 (e17)	c-RCT USA 01/2001 to 09/2001	45 medical practices with 2717 HF patients 69 years, 67% male NYHA: 5/12/13/8%	Patients receive a 1-page summary of the evidence for beta-blocker use and a patient-oriented brochure for distribution IG (n=23 practices with 1701 patients): • Additional patient education videotapes • Feedback on beta-blocker use of their patients with HF • Provider internet education • Access to telephone communication with a HF expert Control group (n=22 practices with 930 participants): No further intervention	unclear/ unclear/ low/ high/ low/ high	Mean proportion of patients taking β-blocker within practices: 12-months: 66 vs. 63%	Intervention did not change the use of β-blocker (RD 0.03; 95%CI -0.01 to 0.07).

Article	Study type recruitment	Population number, age, male, NYHA (I/II/III/IV), comorbidities	Comparison Intervention (IG) vs. control (CG)	Risk of bias (I/II/III/IV/ V/VI)	Patient adherence (measurement, follow-up) IG vs. CG	Conclusions on primary outcome, clinical outcomes and patient's adherence
Laramee 2003 (e21)	RCT USA 07/1999 to 02/2001	287 hospitalized HF patients

71±12 years, 54% male
NYHA: 16/43/33/2%
Diabetes: 43%
Hypertension: 74%
Hyperlipidemia: 57%

Exclusion of patients with cognitive impairment or long-term hemodialysis | IG (n= 141):
• Intervention performed by the chronic HF case manager
• Early discharge planning and coordination of care
• Individualized and comprehensive patient and family education including a 15-page HF booklet
• Telephone follow-up and surveillance (1-3 days after discharge and at weeks 2,3,4,6,8,10,12)
• Promotion of optimal HF medication and medication doses

CG_(n=146):
• Standard care in the hospital and follow-up by the patient's own local physician | unclear/ unclear/ high/ high/ low/ low | Adherence scores: 3-months (higher better): daily weighting: 4.6 vs. 3.1, p<.001
check for edema: 4.8 vs. 4.6, p=.02
low salt diet: 4.8 vs. 4.4, p<0.001
fluid restrictions: 5.0 vs. 4.6, p=.003
medications: 5.0 vs. 4.9, p=.04 ACEIs or ARBs: 84 vs. 80%
β -blocker: 70 vs. 62% | Intervention did not change readmission rates but may have improved adherence to some lifestyle recommendations and medications.
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Article	Study type recruit ment	Population number, age, male, NYHA (I/II/III/IV), comorbidities	Comparison Intervention (IG) vs. control (CG)	Risk of bias (I/II/III/IV/ V/VI)	Patient adherence (measurement, follow-up) IG vs. CG	Conclusions on primary outcome, clinical outcomes and patient's adherence
López-Cabezas 2006 (e13)	RCT Spain 09/2000 to 08/2002	134 hospitalized HF patients 76±9 years, 44% male NYHA I-II/II-IV: 86/14% Diabetes: 34% Hypertension: 61% Renal Failure: 32% Exclusion of patients with any type of dementia or disabling psychiatric disease	IG (n=70): • Active information by a pharmacist • At hospital discharge: personal education of the patient and his caregiver • Telephone monitoring (monthly during 6 months, later every 2 months) • Contact telephone number of the pharmacist CG (n=64): Standard care	low/ low/ high/ high/ low/ unclear	Treatment compliance, reliable patients: 6-months: 91.1 vs. 69% 12-months: 85 vs. 73.9%	Intervention might reduce the number of new admissions and deaths and improve QoL. It can improve medication compliance with potential long-term differences (RD 0.11; 95%CI -0.01 to 0.32).
Luttik 2012 (e14)	RCT (non-inferiorit y trial) Netherla nds	189 HF patients visiting an outpatient HF clinic 73±11 years, 64% male NYHA III/III-IV/IV: 17/22/61% Diabetes: 34% Exclusion of patients with current psychiatric disorder	Optimal treatment and patient education in a outpatient HF clinic IG (n=97): • Follow-up in primary care with no scheduled visits in the HF clinic over 12 months CG (n=92): Follow-up at a specialized HF clinic and care as usual over 12 months	unclear/ unclear/ low/ low/ high/ low	Patient adherence over 12 months: total score: 92.3 vs. 94.4% ACE inhibitor/ARB: 93.5 vs. 95.2% β -Blocker: 93.5 vs. 94.9% MRA: 87.1 vs. 93.3%	Intervention shows non-inferiority in maintenance to guideline adherence and patient's medication adherence (RD -0.02; 95%CI -0.11 to 0.07) and no differences in the number of deaths and readmissions.

Article	Study type recruitment	Population number, age, male, NYHA (I/II/III/IV), comorbidities	Comparison Intervention (IG) vs. control (CG)	Risk of bias (I/II/III/IV/ V/VI)	Patient adherence (measurement, follow-up) IG vs. CG	Conclusions on primary outcome, clinical outcomes and patient's adherence
Mejhert 2004 (e19)	RCT Sweden 01/1996 to 12/1999	208 hospitalized HF patients 76±7 years, 58% male NYHA: 10/62/37/1% Diabetes: 22% Hypertension: 31% Exclusion of patients with dementia	IG (n=103): • Follow-up within a nurse-monitored intervention program with • Nurse checks symptoms, changes doses of medications • Patient education on symptom monitoring, changes of diuretics, dietary advices • Repetition in booklets and computerized education programs • Written information to the general practitioner Control group (n=105): • Follow-up by their general practitioners	unclear/ unclear/ unclear/ high/ high/ low	Goal doses of ACE: 18-months: 88 vs. 74%	Intervention had no favorable effect on QoL, mortality or readmission rate but can optimize medication adherence (RD 0.14; 95%CI 0.04 to 0.24). –

Article	Study type recruitment	Population number, age, male, NYHA (I/II/III/IV), comorbidities	Comparison Intervention (IG) vs. control (CG)	Risk of bias (I/II/III/IV/V/VI)	Patient adherence (measurement, follow-up) IG vs. CG	Conclusions on primary outcome, clinical outcomes and patient's adherence
Murray 2007 (e3)	RCT USA 02/2001 to 06/2004	314 HF stable ambulatory patients 62±8 years, 33% male NYHA: 19/41/35/5% Diabetes: 65% Hypertension: 96% Exclusion of patients with dementia	IG (n=122): • Pharmacy intervention on the basis of a baseline medication history • Patient education about medication (verbal and written) aimed at patients with low literacy • monitoring od patients' medication use, health care encounters and body weight in a study database • as-needed communication with clinical nurses and primary care physicians • interdisciplinary team (pharmacist, geriatrician, cardiologist, behavioral scientist, psychologist) CG (n=192): • prescription service from rotating pharmacists	low/ high/ low/ low/ low/ low	Adherence to medication: intervention period: 78.8 vs. 67.9% 3-months post-intervention period: 70.6 vs. 66.7%	Intervention can improve medication adherence during intervention period (MD 10.9; 95%CI 5.0 to 16.7). The benefit probably requires constant intervention because the effect dissipated in the post-intervention period (MD 3.9; 95%CI -2.8 to 10.7). The intervention can reduce the number of all-cause readmission to the hospital or emergency department and slightly reduces mortality.

Article	Study type recruitment	Population number, age, male, NYHA (I/II/III/IV), comorbidities	Comparison Intervention (IG) vs. control (CG)	Risk of bias (I/II/III/IV/ V/VI)	Patient adherence (measurement, follow-up) IG vs. CG	Conclusions on primary outcome, clinical outcomes and patient's adherence
Mussi 2013 (e31)	RCT Brazil 10/2009 to 11/2012	200 hospitalized HF patients due to decompensation 63±13 years, 63% male NYHA: 7/41/41/11% Diabetes: 36% Hypertension: 69% Depression: 22%	IG (n=101): • Systematic follow-up by HF nurses with home visits (10, 30, 60, 120 days after discharge) with physical examination and education • Four telephone contacts to reinforce education CG (n=99): • Conventional follow-up	low/ unclear/ low/ high/ high/ low	Self-care (EHFScBS): baseline: 34.4±7.7 vs. 34.0±7.7 6-months: 22.4±6.5 (better) vs. 30.9±7.3 Correct answers to treatment adherence: baseline: 46.3±16.2 vs. 45.2±16.4% 6-months: 71.2±13.8 vs. 55.0±15.0%	Intervention can improve knowledge on HF, self-care (MD 8.5; 95%CI 6.3 to 10.8) and knowledge on treatment adherence (MD 14.8; MD 95%Ci 10.0 to 19.7) with no influence on mortality.
Peters-Klimm 2010 (e37)	RCT Germany 06/2006 to 01/2007	199 ambulatory HF patients with former hospitalization from 31 physicians 70±10 years, 73% male NYHA: 3/66/30/1% Diabetes: 34% Hypertension: 79% Depression: 20% Dyslipidemia: 70%	IG (n=99): • Case management by a trained doctor's assistant with telephone monitoring (NYHA III-IV: 3-weekly, NYHA I-II: 6-weekly) and three home visits for one year • Feedback from the assistants to the general physician • Patient leaflet, booklets and tailored diaries Control group (n=100): • Usual care	low/ low/ high/ high/ low/ low	Self-care (EHFscBS): Baseline: 25.4±8.4 vs. 25.0±7.1 12-months: 21.2±6.4 vs. 24.8±6.7	Intervention had only small influence on QoL, mortality and readmissions, but can improve self-care (MD 3.6; 95%CI 1.6 to 5.7).

Article	Study type recruitment	Population number, age, male, NYHA (I/II/III/IV), comorbidities	Comparison Intervention (IG) vs. control (CG)	Risk of bias (I/II/III/IV/ V/VI)	Patient adherence (measurement, follow-up) IG vs. CG	Conclusions on primary outcome, clinical outcomes and patient's adherence
Powell 2010 (e15)	RCT USA 10/2001 to 19/2004	902 ambulatory and hospitalized HF patients 64±14 years, 53% male NYHA II/ III: 68/32% Diabetes: 40% Hypertension: 75% Major depressive symptoms: 29% Exclusion of patients with psychiatric comorbid conditions	IG (n=451): • 18 group-base HF education by advanced trained health professionals (18x2h) over 12 months CG (n=451): Education by 18 HF tip sheets on the same schedule but delivered by mail and telephone contact to answer questions	unclear/ low/ high/ low/ low/ low	Adherence to ACEI or BB therapy decreased over 12 months in both groups from 61.6 vs. 63.6% by 7 percent points Self-efficacy improved in both groups by 0.2 points Salt intake (≤2400 mg/d): 12-months: 28 vs. 18%.	The intervention did not reduce death or HF hospitalization, improve QoL, self-efficacy and drug adherence (OR 0.84; 95%CI 0.6 to 1.18) and can slightly reduce salt intake (RD 0.10; 95%CI 0.05 to 0.15).

Article	Study type recruitment	Population number, age, male, NYHA (I/II/III/IV), comorbidities	Comparison Intervention (IG) vs. control (CG)	Risk of bias (I/II/III/IV/ V/VI)	Patient adherence (measurement, follow-up) IG vs. CG	Conclusions on primary outcome, clinical outcomes and patient's adherence
Riegel 2004 (e42)	RCT USA 1999 to 2001	88 hospitalized HF patients 73±13 years, 42% male NYHA: 5/32/44/19% Diabetes: 46% Hypertension: 82% Exclusion of patients with cognitive impairment	IG (n=45) • Training of 9 patients as mentors (5 classes taught over 2 weeks by specialized nurses) on self-care, monthly meetings of mentors and nurses • Each mentor was assigned to at least 1 mentee • Telephone calls, home visits, joint outings, demonstrations and modelling of mentors and mentees (after discharge from hospital, at least weekly in the 1rst month, monthly in months 2-3) CG (n=43): • Usual care including in-patient education	low/ unclear/ high/ high/ low/ high	Self-care (SCHFI): baseline: 147.4±38.7 vs. 175.3±36.1 3-months: 159.2±46.3 vs. 178.4±29.6 Maintenance: baseline: 63.0±19.4 vs. 64.3±18.6 3-months: 74.5±18.3 vs. 68.9±15.6 Management: baseline: 34.7±16.8 vs. 44.9±14.9 3-months: 38.0±18.2 vs. 46.4±17.7	Intervention increased readmissions and might improve self-care maintenance (MD 5.6; 95%CI -5.2 to 16.4). It was not able to improve final total self-care scores (MD -19.2: -40 to 1.6) and self-care management (MD -8.4; 95%CI -19.7 to 2.9) due to high baseline differences.

Article	Study type recruitment	Population number, age, male, NYHA (I/II/III/IV), comorbidities	Comparison Intervention (IG) vs. control (CG)	Risk of bias (I/II/III/IV/ V/VI)	Patient adherence (measurement, follow-up) IG vs. CG	Conclusions on primary outcome, clinical outcomes and patient's adherence
Rodriguez-Gázquez 2012 (e34)	RCT Columbia 2010	63 HF patients attending a CV health program at a hospital institution 68±11 years, 49% male NYHA I-III (mean±SD): 2.2±0.7 Diabetes: 33% Hypertension: 81% Renal failure: 16% Dyslipidemia: 16% Depression: 3%	IG (n=33): • Educational meeting for patients and their families (during the first month) Workshop on healthy cooking Telephone monitoring (monthly in months 2-7) or home visits (months 1,8) Educative folder during the first meeting CG (n=30): • Standard care • Educational meeting and folder at the end of the study	low/ high/ high/ low/ low/ low	Adherence to pharmacological and non-pharmacological treatment (SCB): baseline: 40.0±6.2 vs. 43.4±5.7 9-months: 52.2±10.1 vs. 48.5±9.0	Intervention might improve self-care in patients with HF (MD 3.7; 95%CI -1.35 to 8.75) with no influence on mortality and hospitalization.
Ross 2004 (e25)	RCT USA 09/2001 to 12/2001	107 HF patients followed in a specialty HF clinic 56 years, 77% male	IG (n=54): • patients receive a user code and password to a web interface to three components: the medical record, an educational guide and a messaging system over 12 months • messaging system allows to exchange secure messages with the nursing staff CG (n=53): • Standard care in the HF clinic	low/ unclear/ high/ low/ low/ low	General Adherence at 12 months: 85 vs. 78, p=0.01 Medication Adherence: 3.6 vs. 3.4, p=0.15	Intervention can improve general adherence (MD 6.4; 95%CI 1.8 to 10.9) and medication adherence (MD 0.2; 95%CI -0.1 to 0.6) with more emergency department visits in the IG and no influence on mortality and QoL.

Article	Study type recruitment	Population number, age, male, NYHA (I/II/III/IV), comorbidities	Comparison Intervention (IG) vs. control (CG)	Risk of bias (I/II/III/IV/V/VI)	Patient adherence (measurement, follow-up) IG vs. CG	Conclusions on primary outcome, clinical outcomes and patient's adherence
Seto 2012 (e46)	RCT Canada 09/2009 to 02/2010	100 ambulatory HF patients at a HF clinic 54±14 years, 79% male NYHA II/II-III/III/IV: 43/11/42/4%	IG (n=50): • tele-monitoring with daily weight and blood pressure measurements and weekly single-led ECGs over 6 months • daily answers to symptom questions on a mobile phone CG (n=50): • Usual care at the clinic with visits at the clinic depending on the severity of HF	low/ unclear/ high/ high/ low/ low	Self-care (SCHFI): Maintenance: baseline: 65.5±18.6 vs. 58.9±18.7 6-months:73.3±11.6 vs. 65.5±15.8 Management: baseline: 58.1±24.5 vs. 57.9±22.4 6-months: 68.6±16.0 vs. 69.3±18.3	Intervention can improve self-care maintenance (MD 7.8; 95%CI 1.8 to 13.8), but not self-care management (MD -0.7; 95%CI -11.5 to 10.1). It improved QoL, but not hospitalization, mortality and emergency care visits. .
Shearer 2007 (e43)	RCT USA winter 2001 to fall 2003	90 hospitalized HF patients 76±8 years, 64% male NYHA:0/43/49/8%	IG (n=45): • Telephone-delivered education by specialized nurses (1-3 days, 2,4,6,8,12 weeks after discharge) CG (n=45): • Usual education on HF from a nurse in the hospital	unclear/ unclear/ high/ low/ low/ low	Self-Management of HF: baseline: 16.4±2.5 vs. 17.0± 2.6 3-months: 19.6±2.2 vs. 18.0±3.0	Intervention had no influence on purposeful participation or QoL, but can improve self-management of HF (MD 1.6; 95%CI 0.3 to 2.8).

Article	Study type recruitment	Population number, age, male, NYHA (I/II/III/IV), comorbidities	Comparison Intervention (IG) vs. control (CG)	Risk of bias (I/II/III/IV/ V/VI)	Patient adherence (measurement, follow-up) IG vs. CG	Conclusions on primary outcome, clinical outcomes and patient's adherence
Shively 2013 (e47)	RCT USA	84 HF patients, hospitalized or emergency department visit within the previous 12 months 66±11 years, 83% male NYHA (I /II/III): 4/33/52% ≥3 comorbid conditions: 71% Exclusion of patients with psychiatric problems	IG (n=43): • individualized intervention depending on the baseline activation level by advanced nurses with self-selected goals • 6 sessions with nurses by telephone or I person in 6 months • Self-management toolkit (blood pressure cuff, weight scale, pedometer, HF self-management DVD, educational booklet) CG (n=41): • Usual care at a primary care provider (physician, nurse practitioner or physician assistant)	low/ unclear/ high/ high/ low/ low	Self-care (SCHFI): baseline: 56.7±17.5 vs. 64.7±20.7 6-months: 65.1±22.7 vs. 70.0±19.2	Intervention can improve patient activation self-management self-concept and adherence and may improve patients' self-care. Hospitalization were improved in patients with low or high baseline activation level-
Smeulders 2009 & 2010 (e35, e58)	RCT Netherlands 10/2004 to 01/2006	317 HF patients with a limitation of physical activity 67±11 years, 73% male NYHA: 0/67/33/0%	IG (n=186): • 6-week self-management group program by a HF-nurse (6 weekly sessions over 2.5 hours) • Telephone calls with co-participants • HF reference book CG (n=131): • Follow-up with the cardiologist and a HF-nurse	low/ low/ high/ low/ unclear/ high	Self-care (EHFscBS): baseline: 47.7±6.0 vs. 48.3±6.7 direct follow-up: 49.8±5.8 vs. 48.7±6.5 12-months: 49.2±6.3 vs. 49.2±6.6	Program can improve self-care behavior directly after the program (MD 1.5; 95%CI 0.4 to 2.5), but they did not achieved over 12 months (MD -0.9; 95%CI -2.2 to 0.35) with no influence on mortality and hospital admissions.

Article	Study type recruitment	Population number, age, male, NYHA (I/II/III/IV), comorbidities	Comparison Intervention (IG) vs. control (CG)	Risk of bias (I/II/III/IV/ V/VI)	Patient adherence (measurement, follow-up) IG vs. CG	Conclusions on primary outcome, clinical outcomes and patient's adherence
Strömberg 2006 (e49)	RCT Sweden	154 HF patients visiting a nurse-led HF clinic 70±10 years, 71 % male	Individualized patient education from a HF-nurse during a follow-up visit in a nurse-led HF-clinic (1 hour) IG (n=82): • additional interactive multimedia program with self-test (30-45 min) CG (n=72): • no additional computer-based education	low/ unclear/ low/ low/ low/ high	Compliance with treatment and self-care: baseline: 11.88 vs. 11.89 mean change over 6 months: -0.21 vs. 0.09 (p=0.09)	Intervention can improve knowledge, but not compliance, QoL and mortality.
Thompson 2005 (e26)	c-RCT UK	106 hospitalized HF patients 73±13 years, 73 % male NYHA III: 75% Charlson comorbidity index: 2.5±1.4 Diabetes: 20%	IG (n=58): • Primarily applied by two experienced HF nurses • Patient education in the hospital • Home visit with education and clinical examination (within 10 weeks after discharge) • Contact number • Visits in a nurse-led outpatient HF clinic (monthly) with education and examinations and recommendation of new therapeutic agents CG (n=48): • Standard care with short explanations by the ward nurse and outpatient appointment 6-8 weeks after discharge	low/ unclear/ high/ unclear/ low/ low	Treatment adherence: few differences at 6 months (not reported). Na restricted diet: 8.9±2.3 vs. 7.3±1.9 (better in IG)	Intervention slightly decreased risk of death or readmissions and QoL with slight difference in general adherence and Na restricted diet (MD 1.6; 95%CI 0.75 to 2.34).

Article	Study type recruitment	Population number, age, male, NYHA (I/II/III/IV), comorbidities	Comparison Intervention (IG) vs. control (CG)	Risk of bias (I/II/III/IV/ V/VI)	Patient adherence (measurement, follow-up) IG vs. CG	Conclusions on primary outcome, clinical outcomes and patient's adherence
Tsuyuki 2004 (e18)	RCT Canada 09/1999 to 04/2000	276 hospitalized HF patients

72±12 years, 58 % male
NYHA: 13/50/33/4% | IG (n=140):
• Before discharge: one-to-one education on the basis of a written educational package
• Adherence aids (medication organizer, administration schedule, daily weight log)
• Telephone contact (2, 4 weeks after discharge, later monthly over 6 months) to reinforce education
• Monthly newsletter

CG (n=136):
• General HF pamphlet. usual care | low/ low/ low/ low/ low/ low | ACE inhibitor adherence: over 6 months: 83.5±29 vs. 86.2±29%. | Intervention did not improve ACE inhibitor use (MD -2.7; 95%CI -9.5 to 4.1), but might reduce CVD-related emergency room visits. |

Article	Study type recruitment	Population number, age, male, NYHA (I/II/III/IV), comorbidities	Comparison Intervention (IG) vs. control (CG)	Risk of bias (I/II/III/IV/ V/VI)	Patient adherence (measurement, follow-up) IG vs. CG	Conclusions on primary outcome, clinical outcomes and patient's adherence
Wakefield 2008 & 2009 (e4, e59)	RCT USA 07/2002 to 09/2005	148 hospitalized HF patients due to exacerbation 69±10 years, 99 % male NYHA: 0/28/65/7%	IG (n=99): • Telephone contact by nurses (three times in the first week after discharge, weekly for 11 weeks) to assess symptoms • Patients received a symptom review checklist, a scale, blood pressure cuff, tape measure, • Patient education • Nurses reinforced the plan for care, made referrals or contacted physicians and employed strategies to improve compliance to treatment plans and encouraged self-management CG (n= 49): • Contact to primary care nurse if needed	unclear/ low/ high/ low/ high/ low	Compliance scores: 3-months: 88 (both intervention groups) vs. 91% 6-months: 86 vs. 91% Self-efficacy to manage disease: 6-months: 6.2±2.0 vs. 7.1±2.2 vs. 7.2±2.0 to manage symptoms: 6-months: 6.0±2.3 vs. 5.8±2.4 vs. 6.2±2.5	Intervention can decrease readmission in both intervention groups with no differences between these groups, higher mortality in the videophone group and no differences in QoL. It shows no long-term differences in compliance (RD -0.05; -0.18 to 0.08), self-efficacy to manage disease (MD -0.5; 95%CI -1.4 to 0.4) and symptoms (MD -0.3; 95%CI -1.3 to 0.7).

Article	Study type recruit ment	Population number, age, male, NYHA (I/II/III/IV), comorbidities	Comparison Intervention (IG) vs. control (CG)	Risk of bias (I/II/III/IV/ V/VI)	Patient adherence (measurement, follow-up) IG vs. CG	Conclusions on primary outcome, clinical outcomes and patient's adherence
Welsh 2013 (e57)	RCT USA	52 HF patients from a cardiologic clinic, community and university hospital 62±10 years, 54 % male NYHA II/III-IV: 48 / 52% Exclusion of patients with cognitive disorders or the presence of a major psychiatric disorder other than depression	IG (n=27): • Dietary individualized education on low-sodium adherence by home visits or phone calls (weekly over 6 weeks) CG (n=25): • Usual care	low/ unclear/ high/ low/ low	Self-care management of a low sodium diet: dietary sodium intake: 6-months: 2262 ±925 vs. 3164 ±886 (p=0.011)	Intervention can decrease dietary sodium intake (MD 901; 95%CI 410 to 1390).
Zamanzadeh 2013 (e44)	RCT Iran 07/2011 to 09/2011	80 hospitalized HF patients 64±11 years, 54% male NYHA III/IV : 48/52% Hypertension: 36% Exclusion of patients with mental illness	IG (n=40): • Customized education (one-hour) in the hospital by a nurse with a booklet for the patient and family members • Post-discharge telephone follow-up (every two weeks over 3 months) by a nurse • Contact number of the nurse CG (n=40): • Usual care provided by the hospital and the attending physician	low/ unclear/ high/ low/ low	Self-care (SCHFI): Maintenance: baseline: 18.5±12 vs. 21.9±14.6 3-months: 75.1±20.7 vs. 31.9±15.5 Management: baseline: 11.9 ±11.9 vs. 16.7±16.7 3-months: 66.5±15.3 vs. 30.3±17.6	Intervention can improve self-care behavior in self-care maintenance (MD 43.2; 95%CI 35.1 to 51.3) and management (MD 36.2; 95%CI 28.9 to 43.5).

CG, Control group; CI, confidence interval; c-RCT, cluster randomized control trial; CVD, cardiovascular disease; DMP, disease management program; EHFscBS, European Heart Failure Self-care behavior scale; HF, heart failure; IG, intervention group; n, number of randomized participants; NYHA, New York Heart Association; MD, mean difference; OR, Odds Ratio; QoL, Quality of life; RD, risk difference; RCT, randomized control trial; SCB, self-care behavior; SCHFI, Self-Care of Heart failure index;
MD, OR, RD>0 describe better adherence in IG
Risk of bias: I, random sequence generation; II, allocation concealment, III, blinding of outcome assessment; IV, incomplete outcome data; V: selective reporting; VI: other bias